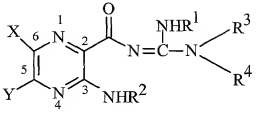
Claims:

1. A compound represented by formula (I):



(I)

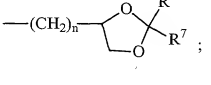
wherein

X is hydrogen, halogen, trifluoromethyl, lower alkyl, unsubstituted or substituted phenyl, lower alkyl-thio, phenyl-lower alkyl-thio, lower alkyl-sulfonyl, or phenyl-lower alkyl-sulfonyl;

Y is hydrogen, hydroxyl, mercapto, lower alkoxy, lower alkyl-thio, halogen, lower alkyl, unsubstituted or substituted mononuclear aryl, or $-N(R^2)_2$;

R^1 is hydrogen or lower alkyl;

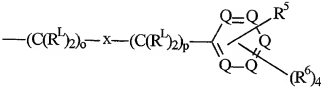
each R^2 is, independently, $-R^7$, $-(CH_2)_m-OR^8$, $-(CH_2)_m-NR^7R^{10}$, $-(CH_2)_n(CHOR^8)(CHOR^8)_n-CH_2OR^8$, $-(CH_2CH_2O)_m-R^8$, $-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$, $-(CH_2)_n-C(=O)NR^7R^{10}$, $-(CH_2)_n-Z_6-R^7$, $-(CH_2)_m-NR^{10}-CH_2(CHOR^8)(CHOR^8)_n-CH_2OR^8$, $-(CH_2)_n-CO_2R^7$, or



;

R^3 and R^4 are each, independently, hydrogen, a group represented by formula (A), lower alkyl, hydroxy lower alkyl, phenyl, phenyl-lower alkyl, (halophenyl)-lower alkyl, lower-(alkylphenylalkyl), lower (alkoxyphenyl)-lower alkyl, naphthyl-lower alkyl, or

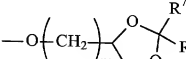
pyridyl- lower alkyl, with the proviso that at least one of R^3 and R^4 is a group represented by formula (A):



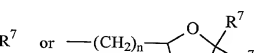
(A)

wherein

each R^L is, independently, $-R^7$, $-(CH_2)_n-OR^8$, $-O-(CH_2)_m-OR^8$, $-(CH_2)_n-NR^7R^{10}$, $-O-(CH_2)_m-NR^7R^{10}$, $-(CH_2)_n(CHOR^8)(CHOR^8)_n-CH_2OR^8$, $-O-(CH_2)_m(CHOR^8)(CHOR^8)_n-CH_2OR^8$, $-(CH_2CH_2O)_m-R^8$, $-O-(CH_2CH_2O)_m-R^8$, $-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$, $-O-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$, $-(CH_2)_n-C(=O)NR^7R^{10}$, $-O-(CH_2)_m-C(=O)NR^7R^{10}$, $-(CH_2)_n-(Z)_g-R^7$, $-O-(CH_2)_m-(Z)_g-R^7$, $-(CH_2)_n-NR^{10}-CH_2(CHOR^8)(CHOR^8)_n-CH_2OR^8$, $-O-(CH_2)_m-NR^{10}-CH_2(CHOR^8)(CHOR^8)_n-CH_2OR^8$, $-(CH_2)_n-CO_2R^7$, $-O-(CH_2)_m-CO_2R^7$, $-OSO_3H$, -O-glucuronide, -O-glucose,



or



;

each o is, independently, an integer from 0 to 10;

each p is an integer from 0 to 10;

with the proviso that the sum of o and p in each contiguous chain is from 1 to 10;

each x is, independently, O, NR^{10}, C(=O), CHOH, $C(=N-R^{10})$, $CHNR^7R^{10}$, or represents a single bond;

each R^5 is, independently, $-(CH_2)_m-OR^8$, $-O-(CH_2)_m-OR^8$, $-(CH_2)_n-NR^7R^{10}$, $-O-(CH_2)_m-NR^7R^{10}$, $-(CH_2)_n(CHOR^8)(CHOR^8)_n-CH_2OR^8$, $-O-(CH_2)_m(CHOR^8)(CHOR^8)_n-CH_2OR^8$, $-(CH_2CH_2O)_m-R^8$,

$-O-(CH_2CH_2O)_m-R^8$, $-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$,

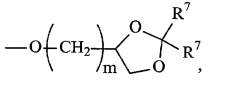
$-O-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$, $-(CH_2)_n-C(=O)NR^7R^{10}$,

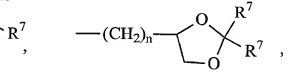
$-O-(CH_2)_m-C(=O)NR^7R^{10}$,$-(CH_2)_n-(Z)_g-R^7$,$-O-(CH_2)_m-(Z)_g-R^7$,

$-(CH_2)_n-NR^{10}-CH_2(CHOR^8)(CHOR^8)_n-CH_2OR^8$,

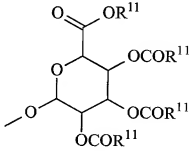
$-O-(CH_2)_m-NR^{10}-CH_2(CHOR^8)(CHOR^8)_n-CH_2OR^8$,

$-(CH_2)_n-CO_2R^7$, $-O-(CH_2)_m-CO_2R^7$, $-OSO_3H$, -O-glucuronide, -O-glucose,





or



;

each R^6 is, independently, $-R^7$, $-OR^{11}$, $-N(R^7)_2$, $-(CH_2)_m-OR^8$,

$-O-(CH_2)_m-OR^8$, $-(CH_2)_n-NR^7R^{10}$, $-O-(CH_2)_m-NR^7R^{10}$,

$-(CH_2)_n(CHOR^8)(CHOR^8)_n-CH_2OR^8$, $-O-(CH_2)_m(CHOR^8)(CHOR^8)_n-CH_2OR^8$,

$-(CH_2CH_2O)_m-R^8$, $-O-(CH_2CH_2O)_m-R^8$, $-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$,

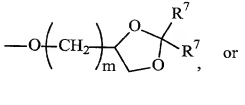
$-O-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$, $-(CH_2)_n-C(=O)NR^7R^{10}$,

$-O-(CH_2)_m-C(=O)NR^7R^{10}$,$-(CH_2)_n-(Z)_g-R^7$,$-O-(CH_2)_m-(Z)_g-R^7$,

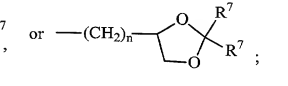
$-(CH_2)_n-NR^{10}-CH_2(CHOR^8)(CHOR^8)_n-CH_2OR^8$,

$-O-(CH_2)_m-NR^{10}-CH_2(CHOR^8)(CHOR^8)_n-CH_2OR^8$,

$-(CH_2)_n-CO_2R^7$, $-O-(CH_2)_m-CO_2R^7$, $-OSO_3H$, -O-glucuronide, -O-glucose,



or



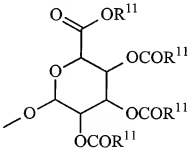
;

wherein when two R^6 are $-OR^{11}$ and are located adjacent to each other on a phenyl ring, the alkyl moieties of the two R^6 may be bonded together to form a methylenedioxy

group;

each R^7 is, independently, hydrogen or lower alkyl;

each R^8 is, independently, hydrogen, lower alkyl, -C(=O)-R^{11}, glucuronide, 2-tetrahydropyranyl, or



;

each R^9 is, independently, -CO_2R^7, -$CON(R^7)_2$, -SO_2CH_3, or -C(=O)R^7;

each R^{10} is, independently, -H, -SO_2CH_3, -CO_2R^7, -C(=O)NR^7R^9, -C(=O)R^7, or -CH_2-$(CHOH)_n$-CH_2OH;

each Z is, independently, CHOH, C(=O), $CHNR^7R^{10}$, $C=NR^{10}$, or NR^{10};

each R^{11} is, independently, lower alkyl;

each g is, independently, an integer from 1 to 6;

each m is, independently, an integer from 1 to 7;

each n is, independently, an integer from 0 to 7;

each Q is, independently, C-R^5, C-R^6, or a nitrogen atom, wherein at most three Q in a ring are nitrogen atoms;

or a pharmaceutically acceptable salt thereof, and

inclusive of all enantiomers, diastereomers, and racemic mixtures thereof.

2. The compound of Claim 1, wherein Y is -NH_2.

3. The compound of Claim 2, wherein R^2 is hydrogen.

4. The compound of Claim 3, wherein R^1 is hydrogen.

5. The compound of Claim 4, wherein X is chlorine.

6. The compound of Claim 5, wherein R^3 is hydrogen.

7. The compound of Claim 6, wherein each R^L is hydrogen.

8. The compound of Claim 7, wherein o is 4.

9. The compound of Claim 8, wherein p is 0.

10. The compound of Claim 9, wherein x represents a single bond.

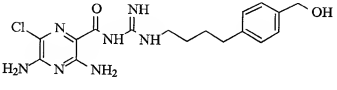
11. The compound of Claim 10, wherein each R^6 is hydrogen.

12. The compound of Claim 11, wherein at most one Q is a nitrogen atom.

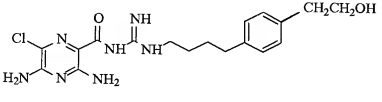
13. The compound of Claim 12, wherein no Q is a nitrogen atom.

14. The compound of Claim 13, wherein R^5 is $-(CH_2)_m-OR^8$.

15. The compound of Claim 14, which is represented by the formula:

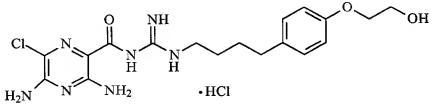


16. The compound of Claim 14, which is represented by the formula:

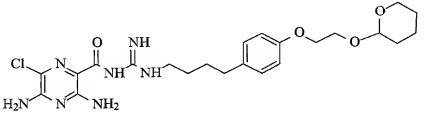


17. The compound of Claim 13, wherein R^5 is $-O-(CH_2)_m-OR^8$.

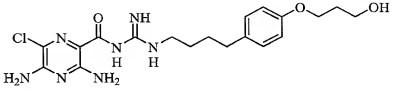
18. The compound of Claim 17, which is represented by the formula:



19. The compound of Claim 17, which is represented by the formula:

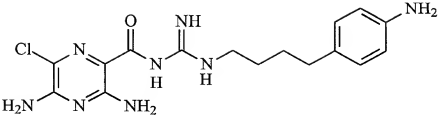


20. The compound of Claim 17, which is represented by the formula:



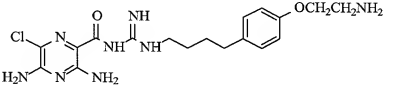
21. The compound of Claim 13, wherein R^5 is $-(CH_2)_n-NR^7R^{10}$.

22. The compound of Claim 21, which is represented by the formula:

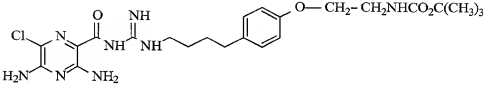


23. The compound of Claim 13, wherein R^5 is -O-$(CH_2)_m$-NR^7R^{10}.

24. The compound of Claim 23, which is represented by the formula:



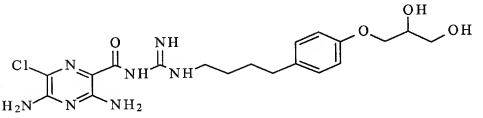
25. The compound of Claim 23, which is represented by the formula:



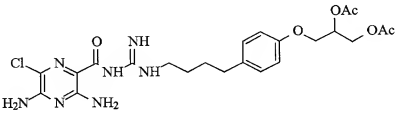
26. The compound of Claim 13, wherein R^5 is -$(CH_2)_q(CHOR^8)(CHOR^8)_n$-$CH_2OR^8$.

27. The compound of Claim 13, wherein R^5 is-O-$(CH_2)_m(CHOR^8)(CHOR^8)_n$-$CH_2OR^8$.

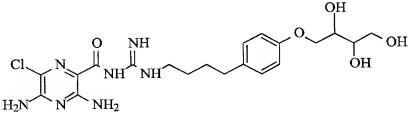
28. The compound of Claim 27, which is represented by the formula:



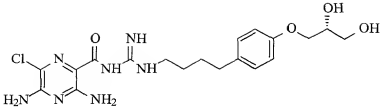
29. The compound of Claim 27, which is represented by the formula:



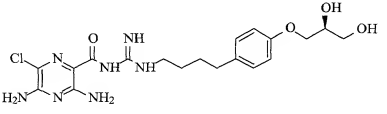
30. The compound of Claim 27, which is represented by the formula:



31. The compound of Claim 27, which is represented by the formula:



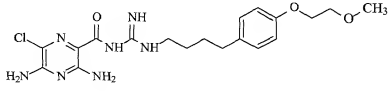
32. The compound of Claim 27, which is represented by the formula:



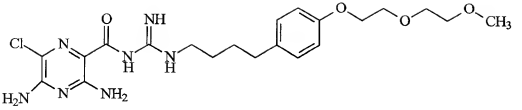
33. The compound of Claim 13, wherein R^5 is $-(CH_2CH_2O)_m-R^8$.

34. The compound of Claim 13, wherein R^5 is $-O-(CH_2CH_2O)_m-R^8$.

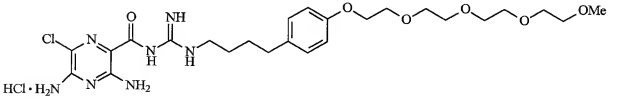
35. The compound of Claim 34, which is represented by the formula:



36. The compound of Claim 34, which is represented by the formula:



37. The compound of Claim 34, which is represented by the formula:



38. The compound of Claim 13, wherein R^5 is $-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$.

39. The compound of Claim 13, wherein R^5 is $-O-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$.

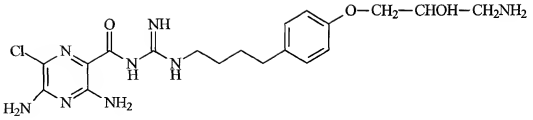
40. The compound of Claim 13, wherein R^5 is $-(CH_2)_n-C(=O)NR^7R^{10}$.

41. The compound of Claim 13, wherein R^5 is $-O-(CH_2)_m-C(=O)NR^7R^{10}$.

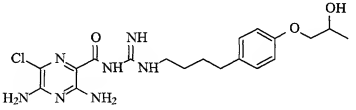
42. The compound of Claim 13, wherein R^5 is $-(CH_2)_n-(Z)_g-R^7$.

43. The compound of Claim 13, wherein R^5 is $-O-(CH_2)_m-(Z)_g-R^7$.

44. The compound of Claim 43, which is represented by the formula:



45. The compound of Claim 43, which is represented by the formula:



46. The compound of Claim 13, wherein R^5 is-$(CH_2)_n$-NR^{10}-$CH_2(CHOR^8)$ $(CHOR^8)_n$-CH_2OR^8.

47. The compound of Claim 13, wherein R^5 is -O-$(CH_2)_m$-NR^{10}-$CH_2(CHOR^8)$ $(CHOR^8)_n$-CH_2OR^8.

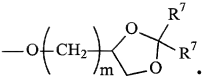
48. The compound of Claim 13, wherein R^5 is -O-$(CH_2)_m$-CO_2R^7.

49. The compound of Claim 13, wherein R^5 is -OSO_3H.

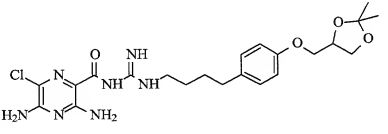
50. The compound of Claim 13, wherein R^5 is -O-glucuronide.

51. The compound of Claim 13, wherein R^5 is -O-glucose.

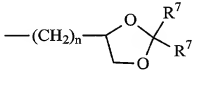
52. The compound of Claim 13, wherein R^5 is



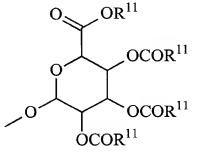
53. The compound of Claim 52, which is represented by the formula:



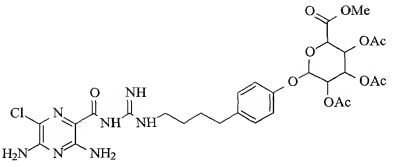
54. The compound of Claim 13, wherein R^5 is



55. The compound of Claim 13, wherein R^5 is



56. The compound of Claim 55, which is represented by the formula:



57. The compound of Claim 1, wherein

X is halogen;

Y is $-N(R^7)_2$;

R^1 is hydrogen or C_1-C_3 alkyl;

R^2 is $-R^7$, $-(CH_2)_m-OR^8$, or $-(CH2)_n-CO_2R^7$;

R^3 is a group represented by formula (A); and

R^4 is hydrogen, a group represented by formula (A), or lower alkyl;

58. The compound of Claim 57, wherein

X is chloro or bromo;

Y is $-N(R^7)_2$;

R^2 is hydrogen or C_1-C_3 alkyl;

at most three R^6 are other than hydrogen as defined above;

at most three R^L are other than hydrogen as defined above; and

at most 2 Q are nitrogen atoms.

59. The compound of Claim 58, wherein Y is $-NH_2$.

60. The compound of Claim 59, wherein R^4 is hydrogen;

at most one R^L is other than hydrogen as defined above;

at most two R^6 are other than hydrogen as defined above; and

at most 1 Q is a nitrogen atom.

61. The compound of Claim 1, wherein R^5 is $-(CH_2)_m-OR^8$.

62. The compound of Claim 1, wherein R^5 is $-O-(CH_2)_m-OR^8$.

63. The compound of Claim 1, wherein R^5 is $-(CH_2)_n-NR^7R^{10}$.

64. The compound of Claim 1, wherein R^5 is $-O-(CH_2)_m-NR^7R^{10}$.

65. The compound of Claim 1, wherein R^5 is $-(CH_2)_n(CHOR^8)(CHOR^8)_n-CH_2OR^8$.

66. The compound of Claim 1, wherein R^5 is $-O-(CH_2)_m(CHOR^8)(CHOR^8)_n-CH_2OR^8$.

67. The compound of Claim 1, wherein R^5 is $-(CH_2CH_2O)_m-R^8$.

68. The compound of Claim 1, wherein R^5 is $-O-(CH_2CH_2O)_m-R^8$.

69. The compound of Claim 1, wherein R^5 is $-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$.

70. The compound of Claim 1, wherein R^5 is $-O-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$.

71. The compound of Claim 1, wherein R^5 is $-(CH_2)_n-C(=O)NR^7R^{10}$.

72. The compound of Claim 1, wherein R^5 is $-O-(CH_2)_m-C(=O)NR^7R^{10}$.

73. The compound of Claim 1, wherein R^5 is $-(CH_2)_n-(Z)_g-R.^7$

74. The compound of Claim 1, wherein R^5 is $-O-(CH_2)_m-(Z)_g-R^7$.

75. The compound of Claim 1, wherein R^5 is $-(CH_2)_n-NR^{10}-CH_2(CHOR^8)(CHOR^8)_n-CH_2OR^8$.

76. The compound of Claim 1, wherein R^5 is -O-$(CH_2)_m$-NR^{10}-$CH_2(CHOR^8)(CHOR^8)_n$-CH_2OR^8.

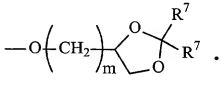
77. The compound of Claim 1, wherein R^5 is -O-$(CH_2)_m$-CO_2R^7.

78. The compound of Claim 1, wherein R^5 is -OSO_3H.

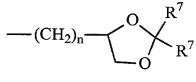
79. The compound of Claim 1, wherein R^5 is -O-glucuronide.

80. The compound of Claim 1, wherein R^5 is -O-glucose.

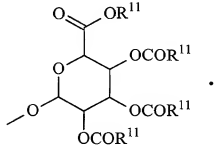
81. The compound of Claim 1, wherein R^5 is



82. The compound of Claim 1, wherein R^5 is



83. The compound of Claim 1, wherein R^5 is



84. The compound of Claim 1, wherein x is a single bond.

85. The compound of Claim 1, which is in the form of a pharmaceutically acceptable salt.

86. A pharmaceutical composition, comprising the compound of Claim 1 and a pharmaceutically acceptable carrier.

87. A method of promoting hydration of mucosal surfaces, comprising:

administering an effective amount of the compound of Claim 1 to a mucosal surface of a subject.

88. A method of restoring mucosal defense, comprising:

topically administering an effective amount of the compound of Claim 1 to a mucosal surface of a subject in need thereof.

89. A method of blocking sodium channels, comprising:

contacting sodium channels with an effective amount of the compound of Claim 1.

90. A method of treating chronic bronchitis, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

91. A method of treating cystic fibrosis, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

92. A method of treating sinusitis, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

93. A method of treating vaginal dryness, comprising:

administering an effective amount of the compound of Claim 1 to the vaginal tract of a subject in need thereof.

94. A method of treating dry eye, comprising:

administering an effective amount of the compound of Claim 1 to the eye of a subject in need thereof.

95. A method of promoting ocular hydration, comprising:

administering an effective amount of the compound of Claim 1 to the eye of a subject.

96. A method of promoting corneal hydration, comprising:

administering an effective amount of the compound of Claim 1 to the eye of a subject.

97. A method of promoting mucus clearance in mucosal surfaces, comprising:

administering an effective amount of the compound of Claim 1 to a mucosal surface of a subject.

98. A method of treating Sjogren's disease, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

99. A method of treating distal intestinal obstruction syndrome, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

100. A method of treating dry skin, comprising:

administering an effective amount of the compound of Claim 1 to the skin of a subject in need thereof.

101. A method of treating esophagitis, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

102. A method of treating dry mouth (xerostomia), comprising:

administering an effective amount of the compound of Claim 1 to the mouth of a subject in need thereof.

103. A method of treating nasal dehydration, comprising:

administering an effective amount of the compound of Claim 1 to the nasal passages of a subject in need thereof.

104. The method of Claim 103, wherein the nasal dehydration is brought on by administering dry oxygen to the subject.

105. A method of preventing ventilator-induced pneumonia , comprising:

administering an effective amount of the compound of Claim 1 to a subject on a ventilator.

106. A method of treating asthma, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

107. A method of treating primary ciliary dyskinesia, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

108. A method of treating otitis media, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

109. A method of inducing sputum for diagnostic purposes, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

110. A method of treating chronic obstructive pulmonary disease, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

111. A method of treating emphysema, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

112. A method of treating pneumonia, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

113. A method of treating constipation, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

114. The method of Claim 113, wherein the compound is administered orally or via a suppository or enema.

115. A method of treating chronic diverticulitis, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

116. A method of treating rhinosinusitis, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

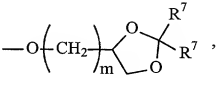
117. A composition, comprising:

the compound of Claim 1; and

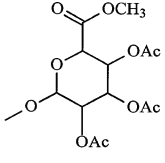
a P2Y2 inhibitor.

118. A composition, comprising:
the compound of Claim 1; and
a bronchodilator.

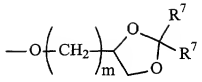
119. The compound of Claim 1, wherein R^5 is selected from the group consisting of -O-$(CH_2)_3$-OH, -NH_2, -O-CH_2-$(CHOH)_2$-CH_2OH -O-CH_2-CHOH-CH_2OH, -O-CH_2CH_2-O-tetrahydropyran-2-yl,-O-CH_2CHOH-CH_2-O-glucuronide, -O-CH_2CH_2OH, -O-$(CH_2CH_2O)_4$-CH_3, -O-$CH_2CH_2OCH_3$, -O-CH_2-(CHOC(=O)CH_3)-CH_2-OC(=O)CH_3, -O-$(CH_2CH_2O)_2$-CH_3, -OCH_2-CHOH-CHOH-CH_2OH, -CH_2OH, -CO_2CH_3,



and

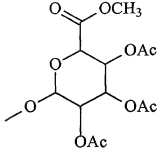


120. The compound of Claim 1, wherein R^5 is selected from the group consisting of para -O-$(CH_2)_3$-OH, para -NH_2, para -O-CH_2-$(CHOH)_2$-CH_2OH, ortho -O-CH_2-CHOH-CH_2OH, meta -O-CH_2-CHOH-CH_2OH, para -O-CH_2CH_2-O-tetrahydropyran-2-yl, para -O-CH_2CHOH-CH_2-O-glucuronide, para -O-CH_2CH_2OH, para -O-$(CH_2CH_2O)_4$-CH_3, para -O-$CH_2CH_2OCH_3$, para -O-CH_2-(CHOC(=O)CH_3)-CH_2-OC(=O)CH_3, para -O-$(CH_2CH_2O)_2$-CH_3, -OCH_2-CHOH-CHOH-CH_2OH, para -CH_2OH, para -CO_2CH_3, para -SO_3H, para -O-glucuronide, para



and

para



121. The compound of Claim 119, wherein

X is chloro or bromo;

Y is $-N(R^7)_2$;

R^1 is hydrogen or C_1-C_3 alkyl;

R^2 is hydrogen or C_1-C_3 alkyl;

R^3 is a group represented by formula (A); and

R^4 is hydrogen, a group represented by formula (A), or lower alkyl;

at most three R^6 are other than hydrogen as defined above;

at most three R^L are other than hydrogen as defined above; and

at most 2 Q are nitrogen atoms.

122. The compound of Claim 121, wherein

R^4 is hydrogen;

at most one R^L is other than hydrogen as defined above;

at most two R^6 are other than hydrogen as defined above; and

at most 1 Q is a nitrogen atom.

123. The compound of Claim 120, wherein

X is chloro or bromo;

Y is $-N(R^7)_2$;

R^1 is hydrogen or C_1-C_3 alkyl;

R^2 is hydrogen or C_1-C_3 alkyl;

R^3 is a group represented by formula (A); and

R^4 is hydrogen, a group represented by formula (A), or lower alkyl;

at most three R^6 are other than hydrogen as defined above;

at most three R^L are other than hydrogen as defined above; and

at most 2 Q are nitrogen atoms.

124. The compound of Claim 123, wherein

R^4 is hydrogen;

at most one R^L is other than hydrogen as defined above;

at most two R^6 are other than hydrogen as defined above; and

at most 1 Q is a nitrogen atom.